

ON A NEW GENUS OF BIRD-CESTODES.

By T. HARVEY JOHNSTON, M.A., B.Sc., Assistant Government
Microbiologist.

(From the Bureau of Microbiology, Sydney, N.S.W.)

[With Plate VIII.]

[Read before the Royal Society of N. S. Wales, September 1, 1909.]

IN May 1894, Professor J. P. Hill collected some entozoa from birds in the Jervis Bay district, amongst them being a single specimen of a cestode taken from the intestine of a bird which he has indicated as a "Jaby, a bird like a crane." Mr. S. J. Johnston, B.A., B.Sc., to whom Dr. Hill gave the specimen informed me that the bird in question was very probably the Jabiru, *Xenorhynchus asiaticus*, Lath. This is the only Australian representative of the family *Ciconiidae* which includes the Storks. It occurs on the Clarence River, (N. S. Wales), in Queensland, in Northern Territory, and in North-west Australia, its occurrence as far south as Jervis Bay being rather unusual.

Unfortunately there was only a single, unstained, mounted specimen, but it possessed such striking characters that I ventured to strip it carefully and then stain it, using haematoxylin after having failed to colour it with borax carmine. I was not able, therefore, to make any sections.

The entire strobila is very small, consisting of a comparatively prominent scolex and some fifty-four segments which together only reach a length of about sixteen millimetres.

Scolex:—When examined in face view, the scolex appears to be roughly rhomboidal with the posterior corner truncate (Plate 8, fig. 2). Its length from the apex to the first

segment is 0·225 mm., its greatest width (excluding the suckers) being 0·187 mm., or 0·226 mm. if we include them. The width at its posterior end is only 0·072 mm.

The rostellum is distinct but short, merely forming the anterior corner of the rhomb. On its apex there is present a more deeply staining disc resembling the apical or rostellar musculature of some other tapeworms, and to it are attached the circlet of hooks. In its centre there is a shallow rounded depression which lends to the opinion that the rostellum is retractile. The organ is not sucker-like. The hooks are arranged in a single circlet of about fourteen. They are comparatively long, thin and prominent, measuring about forty millimetres in total length. The anterior attachment or handle is rather pointed at its free end and only gradually widens towards the guard. It is fairly long (11 μ). Its shape is seen in *Plate 8, fig. 3*. The guard is rather prominent and is regularly rounded. The shaft is by far the longest part of the hook, reaching a length of nearly thirty micra. There is a gradual narrowing until a delicate strongly-incurved extremity is produced.

The four suckers are distinctly projecting, muscular, unarmed organs arranged as a pair on each flat surface. There is only a narrow but comparatively deep depression between each pair. The apertures are directed antero-laterally and measure nearly 0·1 mm. in diameter. The surrounding muscular rim is prominent.

Strobila:—The head becomes narrowed posteriorly to join the segmented part of the strobila. There is no unsegmented neck region, the proglottids commencing immediately behind the scolex. The segments alter considerably in shape and size in different parts of the chain. The first few are many times broader than long; beyond this the segments gradually lengthen into a shape resembling a short bell, the posterior edge of each overlapping the anterior

edge of the succeeding segment only to a moderate degree. Then follow more or less triangular, but still somewhat bell-like segments of relatively considerable length with a delicate anterior and a wide posterior end, the latter projecting very markedly and overlapping the front of the next proglottid. There is now a rather quick decrease in the relative length and an increase in breadth. It is in this region that the genital glands become distinctly recognised, their rudiments appearing in the more elongate segments lying more anteriorly. By this time the bell-shape has become lost and there is now very little overlapping of the now broad anterior portion of each joint by the preceding one. The segments then increase very rapidly in both diameters until the ripe segments are reached, the measurements now remaining fairly constant, the length being about 0.55 mm. and the breadth 0.75 mm. These larger proglottids are only slightly connected with each other.

As mentioned previously, the specimen being unique and in addition, being very small, no part could be sacrificed for sectioning. Consequently very little can be said of the histology and of the position of the excretory canals, nerves, etc.

The cuticle is about two micra in thickness. Below it lie the small subcuticular cells. The longitudinal muscle fibres are only moderately developed. No part of the nervous system could be detected. The only portion of the excretory system recognisable was seen in the region of the developing genitalia. The vessels lie just laterally to the vas deferens on the one side, and in a corresponding situation on the other side. Their position is indicated in the semidiagrammatic fig. 4. The parenchyma appears to be finely granular, but this may not be natural. There are in it numerous oval or rounded calcareous corpuscles from

five to fourteen micra long by from five to seven micra broad. In ripe segments, these bodies are abundant except at the anterior ends around the retractor muscles of the cirrus.

Genitalia:—The genital openings are all placed on the right side. In matured segments, they appear as large cup-shaped depressions with a crenate rim, situated on a very bulky genital papilla which lies near the anterior margin of the segment close to the posterior border of the preceding segment. When the cirrus is everted, the papilla is very prominent.

The genital rudiments may be recognised fairly early as a longitudinally placed mass of cells, somewhat spindle-like, situated in the middle of the segments. Later, the posterior part of this cord differentiates into the small rounded testes and the female complex. The male glands are now seen as a circlet of six vesicles surrounding the developing female glands (*Plate 8, fig. 4*). Each testis is about 10 by 8 μ . The middle and anterior parts of the cord, especially the latter, now become enlarged and develop ultimately into the female and male ducts respectively. The female glands now increase considerably in size. The vagina, the vas deferens and especially the cirrus with its sac become very prominent structures, the cirrus now possessing its characteristic internal covering of bristles arranged with their free ends pointing outwards. By this time the ducts can be traced to the genital opening.

The testes are very few in number, only seven or eight being present. They lie rather more dorsally than the female complex. Their arrangement is very characteristic, six vesicles forming a ring around the immature female glands. This recalls the arrangement described by Prof. Fuhrmann¹ as occurring in his genus *Cyclorchida*. The

¹ Fuhrmann, *Centrb., f. Bact. u. Par., Orig.*, I, XLV, 1908, p. 525; *id.*, *Zool. Jahrb., Supp. Bd.*, x, I, 1908, p. 62.

other vesicles are situated more anteriorly and lie in the medulla on the side remote from the pore-bearing edge and just internally from the excretory vessel of the corresponding side (fig. 4). By the time that the ovary is matured, the testes have already begun to abort.

The vas deferens is a fairly well marked tube also lying on side remote from the pore-bearing edge. It is rather wide and somewhat coiled. After passing forwards close to the excretory vessel it then travels across the segment to enter the cirrus sac. Just before its entry there may be a slight enlargement representing a vesicula seminalis.

The cirrus sac is a very large, powerful organ, at whose inner end is a strong mass of muscular tissue constituting a cirrus-retractor muscle. One can scarcely differentiate between a cirrus and a cirrus sac, though I am using the latter term to distinguish that part which lies nearest the genital pore and is not eversible. The cirrus appears as a comparatively long strong walled structure forming the continuation of the vas deferens. Its walls are beset with a dense covering of bristles whose points are directed outwards while the cirrus is at rest, but when the organ becomes everted these spines come to lie in such a way that their points are backwardly directed. Each spine is then seen to be comparatively large and strong and to resemble a rose thorn in shape, its base being about 3.5μ in diameter and its length 10μ . On the swollen basal part of the cirrus, there are a great number of closely set spines of the same shape but of larger size than those on the other part, their measurements being about 7μ at the base by 17μ in length. There is no appearance of special spines such as those described as occurring at the base of the cirrus in *Acanthocirrus*. Perhaps one should consider the greatly elongated muscular structure which forms a narrow sheath around the inner parts of the retracted cirrus as

being part of the cirrus sac. When the organ is fully everted it extends at least 0.3 mm. Even then a considerable part of the bristled wall still remains within the cirrus, as is shown in fig. 5. In younger segments the organ may be curled at its inner end. The cirrus lies dorsally to the vagina, its opening being just above and in front of the female pore.

The vagina is an exceptionally wide tube, occasionally twisted, with very well defined walls containing some longitudinal muscles. It courses inwards and backwards to the middle of the segment. Its inner end may be slightly swollen and rounded, but as a rule a receptaculum seminis cannot be distinguished.

The ovary is a distinctly bilobed, somewhat branched organ lying just behind the midregion of the segment. Though very small at the time when the testes are approaching their full development, it rapidly increases in size and appears to dwindle again very soon. The description of the female complex is unfortunately not as complete as I would like, but the parts are very hard to distinguish. The rapid growth of the uterus obscures these parts. Neither oviduct nor shell gland are recognisable. As mentioned above, the developing ovary is encircled by the testes.

The vitellarium lies near the posterior edge of the segment as a rounded organ. From it there passes forward a delicate vitelline duct which enters the inner end of the vagina, or as it ought perhaps to be called here, the fertilising duct, just before it opens into the uterus.

The uterus appears rather late but it develops very rapidly, becoming filled with eggs and then assuming a simple sac-like form which it retains. When ripe it almost fills the segment, the vagina, cirrus sac and its muscular system however, still persisting. The fertilising duct

enters it at about the middle of the proglottid. Though the uteri are crowded with ova in various stages, no details could be satisfactorily made out in regard to the eggs and oncospheres.

Systematic position:—The sac-like character of the uterus and the general organisation of the whole worm, indicate that it belongs to Fuhrmann's¹ family *Dilepinidae* and to his subfamily *Dilepininae*. However, it possesses some very striking features which do not allow of its inclusion in any of the known genera. It is therefore proposed to erect for its reception, a new genus, *Clelandia*, in honour of my colleague at the Bureau, Dr. J. B. Cleland, who has shown a very keen interest in parasitology, both in Western Australia and in this State. The characters of the proposed genus, based on its type species *C. parva*, sp. nov., may be stated as follows:—Scolex with powerful unarmed suckers; rostellum with long hooks arranged in a single row on an apical disc; genital pores unilateral; genitalia single; testes few in number and forming a circle round female genitalia; cirrus large and provided with powerful spines, especially on the base, but all of practically similar shape; mature uterus sac-like and nearly filling segment.

The possession of unilateral genitalia separates this new genus from other genera in the same subfamily possessing alternating pores, e.g., *Amæbotænia*, *Fuhrmannia*, *Anomotaenia*, etc., whilst the presence of a single circlet of hooks on the rostellum separates it from allied genera with unilateral pores, e.g., *Dilepis*, *Cyclorchida*, etc.

The main distinguishing characters of *Clelandia* lie in the male genitalia and the rostellar hooks. The arrangement of the testes in a circlet around the female complex only

¹ Fuhrmann, Die Cestoden der Vögel in Zoolog. Jahrb., *loc. cit.*, p. 51.

occurs, as far as I know, in *Cyclorchida*, but this genus possesses a great number of these vesicles (about ninety), and a double circlet of rostellar hooks of a characteristic form viz., there is a powerful base and a small hook part. There is thus very considerable and important differences between these two genera. Though the cirrus sac is beset with strong spines in both, yet the details of this organ are different in each genus.

The other nearly related genus is *Acanthocirrus*, Fuhrm.¹ in which there is no mention of the arrangement of the rostellar hooks, consequently we cannot compare in this direction. The male organs however are quite different to those of *Clelandia*, since the testes, though few in number, are not arranged around the female glands but are situated behind them in the posterior half of the segment. The cirrus and vagina show considerable resemblances to those of our genus, but the large characteristically shaped spines lying in special pouches at the base of the cirrus in *Acanthocirrus* are not present in *Clelandia*.

It appears, therefore, that the new genus lies between *Cyclorchida* and *Acanthocirrus* and approaches more nearly to the former, if we exclude the shape and arrangement of the rostellar hooks. It is worth noting that the only species of the former genus, viz., *C. omalancristrota*, Wedl., and that two out of the three known species of the latter genus, viz., *A. macropus*, Wedl., and *A. cheilancristrota*, Wdl., occur in birds belonging to the Ciconiiformes (Storks and Cranes).

Type species:—*Clelandia parva*, Jnstn., from the intestine of *Xenorhynchus asiaticus*, Lath.?

Locality:—Jervis Bay, N. S. Wales.

¹ Fuhrmann, *Centrb. f. Bact., Orig.*, I, XLV, 1908, p. 527; and in *Zool. Jahrb., Suppl. Bd.*, x, Heft 1, 1908, p. 63.

The type slide has been presented to the Australian Museum, Sydney.

My thanks are due to my friend, Mr. S. J. Johnston, B.A., B. Sc., of Sydney University, for handing the specimen over to me.

REFERENCE TO PLATE VIII.

Clelandia parva, Jnstn.

Explanation of lettering :—*Ap.d.*, apical disc; *c.*, cirrus; *c.s.*, cirrus sac; *e.v.*, excretory vessel; *g.ap.*, genital aperture; *g.h.*, guard of hook; *g.p.*, genital papilla; *h.*, hook; *h.h.*, handle of hook; *l.sp.*, large spines at base of cirrus; *ov.*, ovary; *r.*, rostellum; *r.m.c.*, retractor muscles of cirrus; *s.*, sucker; *s.h.*, shaft of hook; *sp.*, spines on cirrus; *t.*, testes; *ut.*, uterus; *v.*, vitelline duct; *v.d.*, vas deferens; *vg.*, vagina; *vit.*, vitelline gland.

Fig. 1. Entire strobila.

„ 2. Scolex.

„ 3. Hook.

„ 4. Young segment with developing genitalia (slightly diagrammatic).

„ 5. Part of a mature segment—cirrus everted.

„ 6. Large spine from base of cirrus.

All figures except figure 4, were drawn using a camera lucida. The ovary is indicated in figs. 4 and 5, by hatched lines.